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N. DeRiggi

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the application of:

Hiroyuki NIWA et al.

Serial No.: New

[National stage of PCT/JP01/00315 filed January 19, 2001]

Filing Date: February 22, 2002

For: POSITIVE-WORKING RADIATION-SENSITIVE COMPOSITION AND A METHOD FOR THE PRODUCTION OF A RESIST PATTERN EMPLOYING SAME

Examiner: not assigned

Group Art Unit: not assigned

PRELIMINARY AMENDMENT

Box PATENT APPLICATION
Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination of the above-referenced application, please make the following amendments.

AMENDMENTS

In the Specification:

Replace the paragraph beginning on page 8 after the formula with the following rewritten paragraph:

Here, R^{20} and R^{21} each independently represents a hydrogen atom or an alkyl group with 1 to 4 carbons. Y represents an acid labile group *b* or a hydrogen atom, and *m* is 1 to 3. Furthermore, R^{22} and R^{23} represent a hydrogen atom or an alkyl group with 1 to 4 carbons. Y represents an acid labile group *b* or a hydrogen atom. Examples of acid labile group *b* are the methoxymethyl group, methylthiomethyl group, ethoxymethyl group, ethylthiomethyl group, methoxyethoxymethyl group, benzyloxymethyl group, benzylthiomethyl group, phenacyl group, bromophenacyl group, methoxyphenacyl group, methylthiophenacyl group, α -methylphenacyl group, cyclopropylmethyl group, benzyl group, diphenylmethyl group, triphenylmethyl group, bromobenzyl group, nitrobenzyl group, methoxybenzyl group, methylthiobenzyl group, ethoxybenzyl group, methoxycarbonylmethyl group, ethoxycarbonylmethyl group, n-propoxycarbonylmethyl group, isopropoxycarbonylmethyl group, n-butoxycarbonylmethyl group, tert-butoxycarbonylmethyl group, propenyl group, 1-methoxyethyl group, 1-methylthioethyl group, 1,1-dimethoxyethyl group, 1-ethoxyethyl group, 1-ethylthioethyl group, 1,1-diethoxyethyl group, 1-phenoxyethyl group, 1-phenylthioethyl group, 1,1-diphenoxyethyl group, 1-benzyloxyethyl group, 1-benzylthioethyl group, 1-cyclopropylethyl group, 1-phenylethyl group, 1,1-diphenylethyl group, 1-methoxycarbonylethyl group, 1-ethoxycarbonylethyl group, 1-n-propoxycarbonylethyl group, 1-isopropoxycarbonylethyl group, 1-n-butoxycarbonylethyl group, 1-tert-butoxycarbonylethyl group, isopropyl group, sec-butyl group, tert-butyl group, 1,1-dimethylbutyl group, trimethylsilyl group, ethyldimethylsilyl group, methyldiethylsilyl group, triethylsilyl group, isopropyldimethylsilyl group, methyldiisopropylsilyl group, triisopropylsilyl group, tert-butyldimethylsilyl group, methyldi-tert-butylsilyl group, tri-tert-butylsilyl group, phenyldimethylsilyl group, methyldiphenylsilyl group, triphenylsilyl group, methoxycarbonyl group, ethoxycarbonyl group, isopropoxycarbonyl

group, tert-butoxycarbonyl group, acetyl group, propionyl group, butyryl group, heptanoyl group, hexanoyl group, valeryl group, pivaloyl group, isovaleryl group, lauroyl group, myristoyl group, palmitoyl group, stearoyl group, oxalyl group, malonyl group, succinyl group, glutaryl group, adipoyl group, pimeloyl group, suberoyl group, azelaoyl group, sebacoyl group, acryloyl group, propionyl group, methacryloyl group, crotonoyl group, oleoyl group, maleoyl group, fumaroyl group, mesaconoyl group, benzoyl group, phthaloyl group, isophthaloyl group, terephthaloyl group, naphthoyl group, toluoyl group, hydroatropoyl group, atropoyl group, cinnamoyl group, furoyl acid, thenoyl group, nicotinoyl group, isonicotinoyl group, p-toluenesulphonyl group, mesyl group, cyclopropyl group, cyclopentyl group, cyclohexyl group, cyclohexenyl group, 4-methoxycyclohexyl group, tetrahydropyranyl group, tetrahydrofuranyl group, tetrahydrothiopyranyl group, tetrahydrothiofuranyl group, 3-bromotetrahydropyranyl group, 4-methoxytetrahydropyranyl group, 4-methoxytetrahydrothiopyranyl group and the like.

Replace the paragraph beginning on page 10, line 14 with the following rewritten paragraph:

Furthermore, as the compounds of a2) or a3), polymers containing structural units represented by the following general formula (10) are preferred. R^{25} represents a hydrogen atom, an alkyl group with 1 to 4 carbons, a cyano group or a halogen. X is an acid labile group represented by general formula (2) or (4).

Replace the paragraph beginning on page 19, line 3 with the following rewritten paragraph:

The polymer containing the structural units represented by general formula (9) or (10) may be a polymer containing only structural units represented by general formula (9) or (10), but it may also be a polymer containing other monomer units providing the characteristics as a chemically amplified resist are not impaired. Examples of other monomer structures are acrylic acid, methyl acrylate, ethyl acrylate, hydroxyethyl methacrylate, isopropyl acrylate, n-butyl

acrylate, tert-butyl acrylate, methacrylic acid, methyl methacrylate, ethyl methacrylate, hydroxyethyl acrylate, isopropyl methacrylate, n-butyl methacrylate, tert-butyl methacrylate, methyl α -chloroacrylate, ethyl α -chloroacrylate, hydroxyethyl α -chloroacrylate, isopropyl α -chloroacrylate, n-butyl α -chloroacrylate, tert-butyl α -chloroacrylate, methyl α -cyanoacrylate, ethyl α -cyanoacrylate, hydroxyethyl α -cyanoacrylate, isopropyl α -cyanoacrylate, n-butyl α -cyanoacrylate, styrene, p-hydroxystyrene, α -methylstyrene, α -methyl-p-hydroxystyrene, maleic acid, maleic anhydride, crotonic acid, fumaric acid, mesaconic acid, citraconic acid, itaconic acid, itaconic anhydride, acrylonitrile, methacrylonitrile, crotonic nitrile, maleonitrile, fumaronitrile, metaconic nitrile, citraconic nitrile, itaconic nitrile, acrylamide, methacrylamide, crotonic amide, maleamide, fumaramide, mesaconic amide, citraconic amide, itaconic amide, vinylaniline, vinyl-pyrrolidone, vinylimidazole and the like. In the case where the other monomer units have an alkali-soluble group, this alkali-soluble group can be protected with an acid labile group. Specific examples of the acid labile group are those given as examples of acid labile group *b*.

Replace the paragraph beginning on page 21, line 16 with the following rewritten paragraph:

As specific examples of the onium salts, there are diazonium salts, ammonium salts, iodonium salts, sulphonium salts, phosphonium salts, oxonium salt and the like. Preferred examples of the onium salts are diphenyliodonium triflate, diphenyliodonium pinenesulphonate, diphenyliodonium dodecylbenzene-sulphonate, triphenylsulphonium triflate, triphenylsulphonium hexafluoroantimonate, triphenylsulphonium naphthalenesulphonate, (hydroxyphenyl)benzylmethylsulphonium toluenesulphonate and the like.

Replace the paragraph beginning on page 22, line 16 with the following rewritten paragraph:

Specific examples of the diazoketone compounds are 1,3-diketo-2-diazo compounds, diazobenzoquinone compounds, diazonaphthoquinone compounds and the like. As examples of preferred diazoketone compounds, there are the ester of 2,3,4,4'-tetrahydroxybenzophenone and 1,2-naphthoquinonediazide-4-sulphonic acid, and the ester of 1,1,1-tris(4-hydroxyphenyl)ethane and 1,2-naphthoquinonediazide-4-sulphonic acid.

Replace the paragraph beginning on page 28, line 5 with the following rewritten paragraph:

A resist film was obtained in the same way as in Example 1 except that there was used polymer (weight average molecular weight 24000) of the following chemical formula (12) instead of the copolymer employed in Example 1, and then electron beam irradiation and development were carried out. At an exposure of $3.9 \mu\text{C}/\text{cm}^2$, there was obtained a $0.23 \mu\text{m}$ pattern.

Replace the paragraph beginning on page 31, line 1 with the following rewritten paragraph:

A resist film was obtained in the same way as in Example 1 except that there was used polymer (weight average molecular weight 13000) of the following chemical formula (17) instead of the copolymer employed in Example 1, and then electron beam irradiation and development were carried out. At an exposure of $2.7 \mu\text{C}/\text{cm}^2$, there was obtained a $0.23 \mu\text{m}$ pattern.

Replace the paragraph beginning on page 42, line 6 with the following rewritten paragraph:

A resist film was obtained in the same way as in Example 1 except that there was used polymer (weight average molecular weight 8000) of the following chemical formula (38) instead

of the copolymer employed in Example 1, and then electron beam irradiation and development were carried out. At an exposure of $3.5 \mu\text{C}/\text{cm}^2$, there was obtained a $0.24 \mu\text{m}$ pattern.

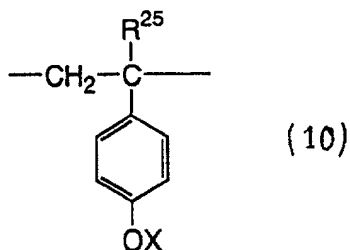
On page 45, after line 11 add the following sentence:

--The results are shown in Tables 1 and 2.--

In the Claims:

Amend claim 17 as follows:

17. (Amended) A positive-working radiation-sensitive composition according to Claim 4 or Claim 8 which is characterized in that the compound meeting condition a2) or a3) is a polymer containing structural units represented by general formula (10).



(R²⁵ represents a hydrogen atom, an alkyl group with 1 to 4 carbons, a cyano group or a halogen. X is an acid labile group represented by general formula (2) or (4).

REMARKS

Applicants have amended the specification to correct typographical errors.

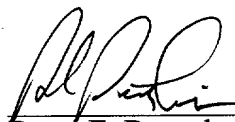
Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "Version with markings to show changes made".

In the event that the transmittal letter is separated from this document and the Patent Office determines that an extension and/or other relief is required, applicants petition for any required relief including extensions of time and authorize the Assistant Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to Deposit Account No. 03-1952 referencing docket no. 360842008500.

Respectfully submitted,

Dated: February 22, 2002

By:



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification:

The paragraph beginning on page 8 after the formula has been amended as follows:

Here, R²⁰ and R²¹ each independently represents a hydrogen atom or an alkyl group with 1 to 4 carbons. Y represents an acid labile group *b* or a hydrogen atom, and m is 1 to 3. Furthermore, R²² and R²³ represent a hydrogen atom or an alkyl group with 1 to 4 carbons. Y represents an acid labile group *b* or a hydrogen atom. Examples of acid labile group *b* are the methoxymethyl group, methylthiomethyl group, ethoxymethyl group, ethylthiomethyl group, methoxyethoxymethyl group, benzyloxymethyl group, benzylthiomethyl group, phenacyl group, bromophenacyl group, methoxyphenacyl group, methylthiophenacyl group, α -methylphenacyl group, cyclopropylmethyl group, benzyl group, diphenylmethyl group, triphenylmethyl group, bromobenzyl group, nitrobenzyl group, methoxybenzyl group, methylthiobenzyl group, ethoxybenzyl group, methoxycarbonylmethyl group, ethoxycarbonylmethyl group, n-propoxycarbonylmethyl group, isopropoxycarbonylmethyl group, n-butoxycarbonylmethyl group, tert-butoxycarbonylmethyl group, propenyl group, 1-methoxyethyl group, 1-methylthioethyl group, 1,1-dimethoxyethyl group, 1-ethoxyethyl group, 1-ethylthioethyl group, 1,1-diethoxyethyl group, 1-phenoxyethyl group, 1-phenylthioethyl group, 1,1-diphenoxyethyl group, 1-benzyloxyethyl group, 1-benzylthioethyl group, 1-cyclopropylethyl group, 1-phenylethyl group, 1,1-diphenylethyl group, 1-methoxycarbonylethyl group, 1-ethoxycarbonylethyl group, 1-n-propoxycarbonylethyl group, 1-isopropoxycarbonylethyl group, 1-n-butoxycarbonylethyl group, 1-tert-butoxycarbonylethyl group, isopropyl group, sec-butyl group, tert-butyl group, 1,1-dimethylbutyl group, trimethylsilyl group, ethyldimethylsilyl group, methyldiethylsilyl group, triethylsilyl group, isopropyldimethylsilyl group, methyldiisopropylsilyl group, triisopropylsilyl group, tert-butyldimethylsilyl group, methyldi-tert-butylsilyl group, tri-tert-butylsilyl group, phenyldimethylsilyl group, methyldiphenylsilyl group, triphenylsilyl group, methoxycarbonyl group, ethoxycarbonyl group, isopropoxycarbonyl

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The paragraph beginning on page 10, line 14 has been amended as follows:

Furthermore, as the compounds of a2) or a3), polymers containing structural units represented by the following general formula (10) are preferred. $[R^{23}] R^{25}$ represents a hydrogen atom, an alkyl group with 1 to 4 carbons, a cyano group or a halogen. X is an acid labile group represented by general formula (2) or (4).

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hydroxyethyl acrylate, isopropyl methacrylate, n-butyl methacrylate, tert-butyl methacrylate, methyl α -chloroacrylate, ethyl α -chloroacrylate, hydroxyethyl α -chloroacrylate, isopropyl α -chloroacrylate, n-butyl α -chloroacrylate, tert-butyl α -chloroacrylate, methyl α -cyanoacrylate, ethyl α -cyanoacrylate, hydroxyethyl α -cyanoacrylate, isopropyl α -cyanoacrylate, n-butyl α -cyanoacrylate, styrene, p-hydroxystyrene, α -methylstyrene, α -methyl-p-hydroxystyrene, maleic acid, maleic anhydride, crotonic acid, fumaric acid, mesaconic acid, citraconic acid, itaconic acid, itaconic anhydride, acrylonitrile, methacrylonitrile, crotonic nitrile, maleonitrile, fumaronitrile, metaconic nitrile, citraconic nitrile, itaconic nitrile, acrylamide, methacrylamide, crotonic amide, maleamide, fumaramide, mesaconic amide, citraconic amide, itaconic amide, vinylaniline, vinyl-pyrrolidone, vinylimidazole and the like. In the case where the other monomer units have an alkali-soluble group, this alkali-soluble group can be protected with an acid labile group. Specific examples of the acid labile group are those given as examples of acid labile group *b*.

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and 1,2-naphthoquinonediazide-4-sulphonic acid, and the ester of 1,1,1-tris(4-hydroxyphenyl)ethane and 1,2-naphthoquinonediazide-4-sulphonic acid.

The paragraph beginning on page 28, line 5 has been amended as follows:

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The paragraph beginning on page 42, line 6 has been amended as follows:

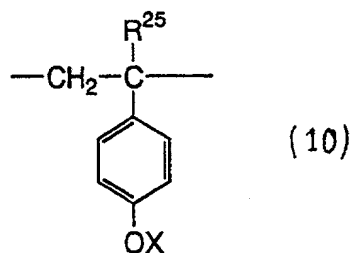
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On page 45, after line 11 add the following sentence:

--The results are shown in Tables 1 and 2.--

In the Claims:

17. (Amended) A positive-working radiation-sensitive composition according to Claim 4 or Claim 8 which is characterized in that the compound meeting condition a2) or a3) is a polymer containing structural units represented by general formula (10).



([R²³] R²⁵ represents a hydrogen atom, an alkyl group with 1 to 4 carbons, a cyano group or a halogen. X is an acid labile group represented by general formula (2) or (4).